WHAT IS CLAIMED IS:

1. A method of using medium having a surface relief pattern on a surface thereof to manufacture a diffractive optical element, said method comprising:

physically contacting a layer of curable material with said surface relief pattern on said surface of said medium to thereby imprint said pattern on a surface of the layer; and

curing said curable material, said curing comprising forming diffractive features comprising refractive index variations in said layer that correspond to said pattern, said forming comprising propagating energy through said medium and from said medium into said layer.

2. The method of Claim 1, wherein said energy comprises electromagnetic energy.

3. The method of Claim 2, wherein said electromagnetic energy comprises ultraviolet (UV) light.

4. The method of Claim 1, wherein said medium is substantially optically transmissive.

5. The method of Claim 4, wherein said medium is substantially optically transmissive to ultraviolet (UV) radiation.

6. The method of Claim 4, wherein said medium has an index of refraction that is substantially the same as the index of refraction of the curable material.

7. The method of Claim 1, wherein said energy is in the form of heat or an electron beam.

8. The method of Claim 1, further comprising removing said medium from said curable material.

9. The method of Claim 1, wherein said medium is selected from the group consisting of tape and a drum.

10. The method of Claim 1, wherein said medium comprises a surface relief hologram.

11. The method of Claim 1, wherein said curable material comprises a polymer selected from the group consisting of urethane, acrylate, and epoxy.

12. The method of Claim 1, wherein said contacting creates an interface between said medium and said layer, said interface having a pattern corresponding to said surface relief pattern, said method further comprising using said interface pattern to mechanically influence the orientation of microstructures in said layer.

13. The method of Claim 12, wherein said microstructures comprise optical liquid.

14. The method of Claim 13, wherein said optical liquid comprises liquid crystal.

15. The method of Claim 14, wherein said liquid crystal comprises nematic liquid crystal.

16. The method of Claim 15, wherein said nematic liquid crystal comprises materials selected from the group consisting of E7 materials, BL material, and TL compounds.

17. The method of Claim 15, wherein said nematic liquid crystal comprises materials selected from the group consisting of mixtures of cyanobiphenyls and higher aromatic homologues, and mixtures of chloro and fluoro substituted mesogens.

18. The method of Claim 12, wherein said layer has a surface opposite said interface, the method further comprising propagating energy through said interface pattern towards said opposite surface.

19. The method of Claim 1, additionally comprising further curing said curable material.

20. The method of Claim 19, wherein said further curing comprises exposing said curable material to additional energy.

21. The method of Claim 20, wherein said energy comprises electromagnetic energy.

22. The method of Claim 21, wherein said electromagnetic energy comprises UV light.

23. The method of Claim 21, wherein said energy comprises heat.

24. The method of Claim 1, wherein said curing includes corona treatment.

25. The method of Claim 1, wherein said curable material comprises liquid crystal and said method further comprises surrounding said curable material with a pair of electrodes

for applying an electrical field across said liquid crystal to alter optical characteristics of said curable material.

26. The method of Claim 25, further comprises providing electrically conductive substantially optically transmissive material to form said electrodes.

27. The method of Claim 25, further comprises laminating electrically conductive substantially optically transmissive material to form said electrodes.

28. The method of Claim 26, comprising depositing indium tin oxide (ITO) to form at least one of said electrodes.

29. The method of Claim 25, further comprising:

removing said medium having a surface relief pattern from said layer of curable material; and

forming an index matching layer against said imprinted pattern on said layer of curable material, said index matching layer comprising material that has an index of refraction substantially identical to that of said curable material.

30. The method of Claim 29, wherein said index matching layer is electrically conductive.

31. The method of Claim 1, wherein said diffractive optical element comprises a diffuser.

32. The method of Claim 1, wherein said diffractive optical element comprises a diffraction grating.

33. A method of using first and second media having first and second surface relief patterns on respective surfaces thereof to manufacture a diffractive optical element, said method comprising:

physically contacting a layer of curable material with said first surface relief pattern on said surface of said first medium to thereby imprint said first pattern on a surface of the layer; and

curing said curable material, said curing comprising forming diffractive features comprising refractive index variations in said layer that correspond to said first pattern on said first medium, said forming comprising propagating energy through said first medium and from said first medium into said layer.

physically contacting said layer of curable material with said surface relief features on said surface of said second medium to thereby imprint said second pattern on another surface of the layer such that two surface relief patterns on opposite sides of said layer surround said index of refraction variations.

34. A method of using a medium having a surface relief pattern on a surface thereof to manufacture a volume hologram, said method comprising:

physically contacting a layer of curable material with said surface relief pattern on said surface of said medium to thereby imprint said pattern on a surface of said layer;

and forming diffractive features in said layer by propagating energy through said medium and from said medium into said layer such that refractive index variations corresponding to said pattern are created in said layer.

35. The method of Claim 34, wherein said curable material comprises liquid crystal.

36. The method of Claim 35, further comprising providing electrodes on opposite sides of said curable material for applying an electric field across said layer of curable material to alter one or more optical characteristics thereof.

37. The method of Claim 36, further comprising forming a pair of layers of electrically conductive substantially optically transmissive material as said electrodes.

38. The method of Claim 37, comprising providing indium tin oxide (ITO) to form said electrodes.

39. The method of Claim 38, further comprising:

removing said medium having a surface relief pattern from said layer of curable material; and

forming an index matching layer against said imprinted pattern on said layer of curable material, said index matching layer comprising material that has an index of refraction substantially identical to that of said curable material.

40. The method of Claim 39, wherein said index matching layer is electrically conductive.

41. A method of using surface relief features on a surface of a medium to manufacture a volume hologram comprising:

physically contacting said surface relief features on said surface of said medium with a surface of a layer of curable material; and

forming a pattern of diffractive features in said layer by propagating electromagnetic energy through the surface relief features of the medium and from the medium into said layer, the formation of said pattern of diffractive features being dependent on said surface relief features, and substantially independent of any diffraction of said energy by said surface relief features during propagation through said medium.

42. The method of Claim 41, wherein said diffractive features comprise index of refraction variations.

43. The method of Claim 41, wherein said curable material comprises a polymer selected from the group consisting of urethane, acrylate, and epoxy.

44. The method of Claim 41, wherein said electromagnetic energy comprises ultraviolet light.

45. The method of Claim 41, wherein said physically contacting surface relief features comprises forming indentations in said layer of curable material.

46. The method of Claim 41, wherein said medium comprise a surface relief hologram.

47. A method of utilizing a medium having a surface relief pattern on a surface thereof to manufacture an optical element having a multiplicity of diffractive features comprising:

physically contacting said surface relief pattern with a layer of curable material such that said pattern and said layer are in contact over a contact area of said layer; and

forming said diffractive features in said layer by illuminating said contact area with light having an intensity distribution substantially free of interference fringes.

48. The method of Claim 47, wherein said optical element is selected from the group consisting of a hologram, a diffraction grating, and a diffuser.

49. The method of Claim 47, wherein said illuminating comprises directing substantially incoherent light on said contact area.

50. The method of Claim 49, wherein said incoherent light has a coherence length of less than or equal to about several wavelengths.

51. The method of Claim 49, wherein said contact area is illuminated with white light.

52. The method of Claim 49, wherein said contact area is illuminated with sunlight.

53. The method of Claim 49, wherein said illuminating comprises directing light from a light source selected from the group consisting of an arc lamp, an incandescent lamp, and a fluorescent lamp onto said contact area.

54. The method of Claim 47, wherein said curable material comprises liquid crystal.

55. The method of Claim 54, further comprising providing electrodes on opposite sides of said curable material for applying an electric field across said layer of curable material to alter one or more optical characteristics thereof.

56. The method of Claim 55, further comprising forming a pair of layers of electrically conductive substantially optically transmissive material as said electrodes.

57. The method of Claim 56, comprising providing indium tin oxide (ITO) to form said electrodes.

58. The method of Claim 55, further comprising:

removing said medium having a surface relief pattern from said layer of curable material; and

forming an index matching layer against said imprinted pattern on said layer of curable material, said index matching layer comprising material that has an index of refraction substantially identical to that of said curable material.

59. The method of Claim 58, wherein said index matching layer is electrically conductive.

60. A diffractive optical element, comprising:

a sheet comprised of a material having diffractive features formed by a predetermined pattern of refractive index variations, said diffractive features originating at an undulating boundary and extending only from one side of said boundary into said material, said undulating boundary having an undulating pattern that corresponds to the predetermined pattern of refractive index variations.

61. The diffractive optical element of Claim 60, wherein said sheet comprises first and second portions that come together at said boundary, at least said first portion comprised of said material, said diffractive features extending from said boundary into said first portion.

62. The diffractive optical element of Claim 61, wherein said first and second portions have substantially identical thermal coefficients of expansion.

63. The diffractive optical element of Claim 61, wherein said first and second portions have substantially identical indices of refraction such that light is not reflected from said boundary.

64. The diffractive optical element of Claim 63, wherein said first and second portions are both comprised of said material.

65. The diffractive optical element of Claim 61, wherein said first and second portions are fused together at said boundary.

66. The diffractive optical element of Claim 65, wherein said first and second portions are fused together by covalent bonding.

67. The diffractive optical element of Claim 60, wherein said first and second portions both comprise substantially optically transmissive material.

68. The diffractive optical element of Claim 61, wherein said second portion has diffractive features formed by a predetermined pattern of refractive index variations.

69. The diffractive optical element of Claim 68, wherein said diffractive features in said second portion originate at another undulating boundary and extend from said another boundary into said second portion, said another undulating boundary having an undulating pattern that corresponds to a predetermined pattern of refractive index variations in said second portion.

70. The diffractive optical element of Claim 69, wherein the predetermined pattern of refractive index variations in said second portion corresponds to said predetermined pattern of refractive index variations in said second portion.

71. The diffractive optical element of Claim 69, further comprising one or more layers containing a predetermined pattern of refractive index variations therein.

72. The diffractive optical element of Claim 61, wherein said first and second portions comprise a UV curable polymer.

73. The diffractive optical element of Claim 61, wherein said first portion comprise liquid crystal.

74. The diffractive optical element of Claim 73, wherein said second portion comprises liquid crystal.

75. The diffractive optical element of Claim 61, wherein said material in said sheet comprises liquid crystal.

76. The diffractive optical element of Claim 75, further comprising electrodes disposed on opposite sides of said sheet to induce an electric field across said sheet upon application of a voltage.

77. The diffractive optical element of Claim 75, wherein said material in said first portion of said sheet comprises liquid crystal.

78. The diffractive optical element of Claim 77, further comprising a first electrode adjacent said first portion and a second electrode adjacent said second portion for application of a voltage across at least said first and second portions of said sheet.

79. The diffractive optical element of Claim 78, wherein said first and second portions have substantially identical indices of refraction such that light is not reflected from said boundary.

80. A diffractive optical element, comprising:

a layer of material having diffractive features formed by a predetermined pattern of refractive index variations; and

a surface relief pattern formed on said layer, said surface relief pattern corresponding to said predetermined pattern of refractive index variations.

81. The diffractive optical element of claim 80, wherein said diffractive features collectively form a volume hologram.

82. The diffractive optical element of claim 80, further comprising a coating over said surface relief pattern, wherein said coating and said layer have substantially identical coefficients of thermal expansion.

83. The diffractive optical element of claim 80, further comprising a coating over said surface relief pattern, wherein said coating and said layer have substantially identical indices of refraction.

84. The diffractive optical element of claim 80, wherein said layer of material comprises liquid crystals in a polymer.

85. The diffractive optical element of Claim 84, comprising a polymer coating on the surface relief pattern.

86. The diffractive optical element of Claim 80, further comprising an additional surface relief pattern on said layer, said two surface relief patterns on opposite sides of said layer.

87. The diffractive optical element of Claim 86, further comprising electrodes surrounding said layer of material having diffractive features for inducing an electric field across said layer of material.

88. The diffractive optical element of claim 87, further comprising:

a coating over said surface relief pattern, wherein said coating and said layer have substantially identical indices of refraction; and

a first electrode adjacent said layer of material and a second electrode adjacent said coating thereon for inducing an electric field across said layer of material.

89. A diffractive optical element formed by a method comprising:

physically contacting a layer of curable material with a surface relief pattern on a surface of a medium to thereby imprint said pattern on a surface of said layer; and

forming diffractive features in said layer by propagating energy through said medium and from said medium into said layer such that refractive index variations corresponding to said pattern are created in said layer.

90. The diffractive optical element of Claim 89, wherein said medium is removed from said layer containing diffractive features.

91. The diffractive optical element of Claim 89, wherein said diffractive features collectively form a volume hologram.

92. The diffractive optical element of Claim 89, wherein said diffractive features collectively form a diffraction grating.

93. The diffractive optical element of Claim 89, wherein said diffractive features collectively form a diffuser.

94. The diffractive optical element of Claim 89, wherein said curable material comprises liquid crystal and said method further comprises surrounding said curable material with a pair of electrodes for applying an electrical field across said liquid crystal to alter optical characteristics of said curable material.

95. The diffractive optical element of Claim 94, further comprising providing electrically conductive substantially optically transmissive material to form said electrodes.

96. The diffractive optical element of Claim 95, comprising indium tin oxide (ITO) to form said electrodes.

97. The diffractive optical element of Claim 94, further comprising:

removing said medium having a surface relief pattern from said layer of curable material; and

forming an index matching layer against said imprinted pattern on said layer of curable material, said index matching layer comprising material that has an index of refraction substantially identical to that of said curable material.

98. The diffractive optical element of Claim 97, wherein said index matching layer is electrically conductive.

99. A method of manufacturing a diffractive optical element using a first medium having a first surface relief pattern on a surface thereof and a second medium having a second surface relief pattern on a surface thereof, said method comprising:

physically contacting one side of a layer of curable material with said first surface relief pattern on said surface of said medium to thereby imprint said pattern on said side of the layer;

physically contacting another side of a layer of curable material with said second surface relief pattern on said surface of said medium to thereby imprint said pattern on said another side of the layer; and

curing said curable material, said curing comprising forming diffractive features comprising refractive index variations in said layer that correspond to said pattern, said forming comprising propagating energy through said first medium and from said first medium into said layer.

100. The diffractive optical element of Claim 99, wherein said curable material comprises liquid crystal and said method further comprises surrounding said curable material with a pair of electrodes for applying an electrical field across said liquid crystal to alter optical characteristics of said curable material.

101. The diffractive optical element of Claim 100, further comprising providing electrically conductive substantially optically transmissive material to form said electrodes.

102. The diffractive optical element of Claim 101, comprising providing indium tin oxide (ITO) to form said electrodes.

103. A diffractive optical element comprising:

a sheet comprising substantially optically transmissive material and having surface relief patterns on opposite sides and an index variation within said substantially optically transmissive material, said index variations coinciding with at least one of said surface relief patterns.

104. The diffractive optical element of Claim 103, further comprising a substantially optically transmissive coating formed on said sheet.

105. The diffractive optical element of Claim 104, wherein said substantially optically transmissive coating is index matched to said sheet.

106. The diffractive optical element of Claim 105, wherein said surface relief patterns on opposite sides of said sheet are substantially identical.

107. The diffractive optical element of Claim 103, wherein said material in said sheet comprises liquid crystal.

108. The diffractive optical element of Claim 107, further comprising electrodes disposed on opposite sides of said sheet to induce an electric field across said sheet upon application of a voltage.